Post T Tauri stars in the solar neighborhood: isolated or members of young associations and moving groups

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Abstract

Post T Tauri stars (PTTS) are late-type stars in the age range between 10 and 100 Myr filling the gap between T Tauri and zero-age main-sequence phases. This period of evolution remains ambiguous and until now different studies of young stars have failed to find the numbers of PTTS that are expected. In the last years some PTTS have been identified among the X-ray detected pre-main sequence stars in some star-forming regions. More recently, additional PTTS have been identified in young associations and moving groups (β Pic, TW Hya, Tucana/Horologium, and the AB Dor). However, many isolated PTTS still remain undiscovered. In this contribution, we compiled the PTTS previously identified in the literature, and identified new candidates using the information provided by the high resolution spectra obtained during our surveys of late-type stars possible members to young moving groups (Montes et al. 2001a, López-Santiago, et al. 2005, 2006), FGK stars in the solar neighborhood (Martínez-Arnáiz et al. 2008), and stars in the RasTyc sample (cross-correlation of the ROSAT All-Sky Survey (RASS) with the TYCHO catalog, Guillout et al. 2008). To identify PTTS we applied an age-oriented definition using relative age indicators (Lithium abundance, chromospheric emission and kinematics) as well as color-magnitude diagrams and pre-main sequence isochrones.

Observations

High resolution spectroscopic observations have been taken during several observing runs in La Palma and Calar Alto observatories from 1999 to 2004 during our spectroscopic survey of possible members of young moving groups. Additional spectra from some southern stars have been taken with the ESO 2.2m telescope using FEROS spectrograph. In addition, since 2005 we are observing FGK stars in the solar neighbourghood (d < 25 pc) mainly with FOCES/ 2.2m and SARG/TNG spectrographs. Spectra of the RasTyc sample have been obtained at OHP (Observatoire de Haute Provence), TNG, and OAC (Osservatorio Astrofisico di Catania).
The obtained spectra have spectral resolution around 40000 – 50000 and cover a spectral range from 3500 to 9000 Å, from the Ca II H & K (3933, 3968 Å) to the Ca II IRT (8498, 8542, 8662 Å) lines.
Reference stars of similar spectral type and radial velocity standard stars have also been observed with the same configuration.

Selection from the Lithium (Age)

The possible Post Tauri stars (PTTS) and young stars analysed in this contribution have been selected from our catalog of late-type stars (F to M) members of young stellar kinematic groups (Montes et al. 2001a, MNRAS, 348, 45) and the RasTyc sample (Guillout et al. 1999, A&A, 351, 1003; 2008). A large number of these stars have been observed by us during the last years with high resolution spectroscopy (Montes et al. 2001b, A&A, 379, 976; López-Santiago 2005, PhD Thesis UCM; López-Santiago et al. 2006, ApJ, 643, 1160; Montes et al. 2008, CS14; Klutsch et al. 2008, CS14; Guillout et al. 2008).

Using the equivalent width of the Li I line at 6707.8 Å, EW(Li I), determined by us plus additional values taken from the literature we have selected the stars with EW(Li I) above the upper envelope of the Pleiades open cluster (78 Myr), see Figs. 1 and 2. The membership to young moving groups like the Local Association, AB Dor, β Pic and Tuc-Hor is indicated in Fig. 2 with different symbols (see also the U, V diagram in Fig. 4).

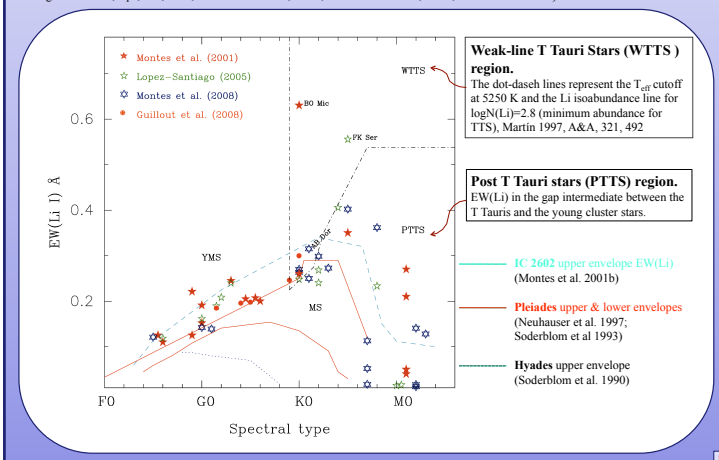
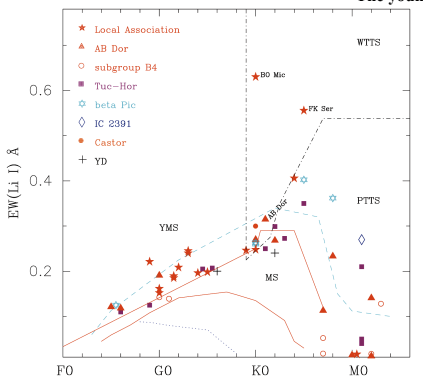


Fig. 1: Equivalent width of the Li I line at 6707.8 Å as a function of spectral type for the selected stars, compared with the envelopes of well-known stellar clusters (ages from 10 to 600 Myr).

The younger PTTS of the sample:



Name	Tsp	EW(LiI) (mÅ)	MG
BD+45 598	K0	300	Castor
UY Pic	K0	270	AB Dor
PZ Tel	K0	260	β Pic
V343 Nor	K0	264	β Pic
BD+17 4799	K0	248	LA
AB Dor	K1	315	AB Dor
AB Pic	K2	299	Tuc-Hor
BD+17 232	K4	406	LA
AO Men	K5	402	β Pic
HD 3221	K5	350	Tuc-Hor
HD 139751	K7	113	AB Dor
HIP 23309	K8	362	β Pic
LO Peg	K8	233	AB Dor
HIP 1910	M0	210	Tuc-Hor
V1005 Ori	M1	270	IC2391
GSC8894-426	M2	141	AB Dor
HIP 17695	M3	128	B4

Fig. 2: As Fig. 1 but in this case different symbols are used to identify the stars members of the Local Association, AB Dor moving group, and B4 subgroup (see López-Santiago et al. 2006), IC2391 and Castor moving groups (Montes et al. 2001a) and β Pic and Tuc-Hor associations (Zuckerman & Song 2004).

Spectra of some β Pic Moving Group members

Here we show some representative spectra of one young stellar kinematic group, the β Pic association.

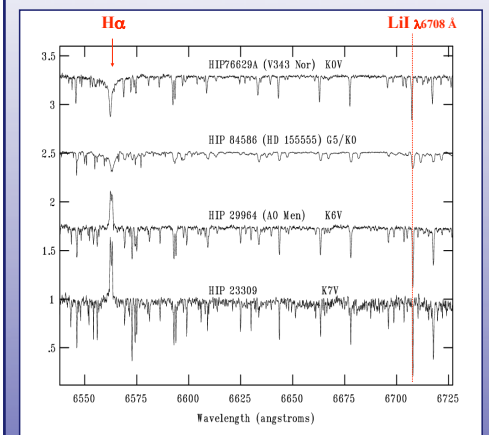


Fig. 3: High resolution spectra of possible members of the β Pic moving group in the Hα and Li I λ6708 Å line region. Note the intense Hα emission of AO Men and HIP 23309. HD 155555 is a SB2 system and the Li I line from both components is detected.

Kinematics of the possible PTTS

The kinematics (galactic space velocity components, U, V) indicate that the whole selected stars are in the region of the young disk stars and very close to the position of the Local Association and other very young stellar associations and moving groups like AB Dor, subgroup B4 of the Local Association, β Pic, Tuc-Hor, IC 2391 and Castor.

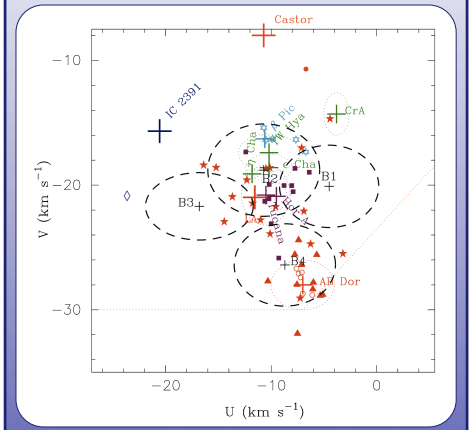


Fig. 4: Position in the (U, V)-plane of the stars selected as possible PTTS.

Additional FGK stars (d < 25 pc)

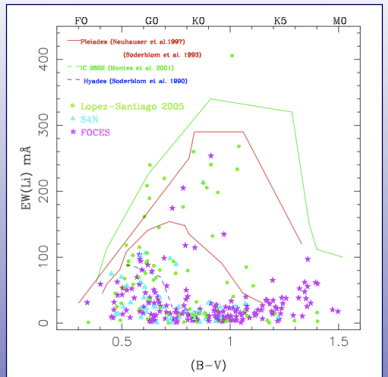


Fig. 5: As Fig. 1, for the stars in our recent survey of FGK stars in the solar neighbourhood (d < 25 pc), see Martínez-Arnáiz et al. and Maldonado et al. posters. We identify additional stars with ages between those of the Pleiades and the Hyades, but any new PTTS.

Acknowledgments

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